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Topological Insulators and Semimetals with Point Group Symmetries[1] CHEN FANG, Princeton University, MATTHEW GILBERT, University of Illinois at Urbana Champaign, XI DAI, Chinese Academy of Sciences, ANDREI BERNEVIG, Princeton University — In this work, we study the theory of topological phases in systems with point group symmetries (PGSs) in one-, two- and three-dimension. The systems we study in general do not require time-reversal symmetry, and hence may be realized in both non-magnetic and magnetic materials. We show that a point group symmetry introduces new quantum numbers which reveal themselves in the entanglement spectrum as mid-gap states. PGSs also define a series of topological semimetals, in which the band touching points are protected by certain symmetries. We apply our theory to 3D ferromagnetic semimetal $HgCr_2Se_4$ which possesses a double-vortex band crossing protected by C_4 rotation symmetry.

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Chen Fang
Princeton University

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